The Taxonomy of the Moss *Archephemeropsis trentepohlioides* Renn.

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This highly interesting New Zealand moss was discovered in 1928 by K. W. Allison at Atiamuri, Thermal District, North Island, and was referred by me to the late H. N. Dixon, who considered it as conspecific with the East Indian *Ephemeropsis tjibodensis* Goeb. This has a unique gametophyte, being without stem or leaves except for the very small bracts, and consisting only of a freely branched alga-like protonema. The branches function as assimilatory organs, thus compensating for the absence of foliage. The general appearance of the New Zealand plant, when barren, is that of an alga or the protonema of some other moss. It forms small yellow-brown patches on the bark of various shrubs and lianes. The seta and capsule can attain a length of 1 cm. and 1 mm. respectively, and it is only this comparatively conspicuous sporophyte that enables the moss to be recognised in the field. Even so, it can escape notice only too frequently, and though fairly widely distributed, it has seldom been collected. *Ephemeropsis tjibodensis* was discovered by Goebel in Java about 1887, and has since been collected in several East Indian countries. Goebel's plants were barren, and for over ten years the little moss was only known by its curious gametophyte which, in the East Indies, usually grows on the leaves of trees in dense moist forest. Goebel quite naturally referred his discovery to the family Ephemeraceae, and created the above genus for it, but when Fleischer found fertile plants in 1898 the surprising fact was revealed that there could be no relationship here to Ephemeraceous mosses because these have a primitive, gymnostomous and sessile capsule, whereas the present plant had the capsule far exserted, with a highly developed double peristome, the whole structure indicating an undoubted affinity with Hookeriaceae. Fleischer (1929) put forward the view that the plant could not be considered as a primitive type, but that its vegetative parts constitute a reduction or reversion to what is probably the primeval gametophyte of the mosses, and that that structure was, or was closely related to, the algal genus *Trentepohlia*. There appears to be no other explanation to account for the association of such a highly developed sporophyte with such a primitive gametophyte. Fleischer created the family Nemataceae for the Indian moss, and its position is recognised as being in the order Hookeriales. Widely divergent views have been expressed as to the taxonomic position of the New Zealand moss. Dixon (1928) gave an account of it in which, after recognising certain differences in the gametophyte, he found the fruiting characters to be practically identical with those of the East Indian species, and arrived at the conclusion that varietal status, at the most, might be allowed if the vegetative characters proved to be constant. In a later notice (1929) he treated the two plants as

identical, at any rate from a systematic point of view. Fleischer (1929) considered that the New Zealand plant was probably a new species, and Renner (1934) in a subsequent investigation of material from Atiamuri and Ohakune, Mount Ruapehu, raised it to generic rank as *Archephemeropsis trentepohlioides*. It should be mentioned that Dixon, in subsequent correspondence with me, agreed that a new species was involved and was also inclined to accept the new genus, though he expressed some doubt about it. The reasons given for founding the genus are based on fruiting as well as vegetative characters, and in order to appreciate them I have studied material from the above localities and also from Marlborough, in the South Island. Taking the vegetative characters first, it is common ground that the gametophyte in the New Zealand plant differs in having the protonemal branches longer, narrower, and less divergent, and in lacking the long erect filaments (Fleischer's "Assimilationsorgane") which function as organs of assimilation. Further differences are its longer rhizoids and the absence of the peculiar geminate and flabelliform organs of attachment ("Hapteren") which in *Ephemeropsis tjibodensis* serve to secure the plant to the surface of the leaf on which it usually grows. Brood-bodies, too, occur on the protonema there, but have not been found on that of *Archephemeropsis*. Such differences as these are of subordinate importance, and there would be general agreement with Dixon's opinion (1928) that they would have to be supported by sporophytic characters in order to be of specific value. The differences in the sporophyte, however, are more significant. Apart from certain deviations which are either of minor importance or which, as for instance a slight roughness of the seta and a larger capsule, are (from what I have seen) not always constant in the New Zealand plant, there are two characters, stressed by Renner, which are more decisive. The first is the structure of the outer teeth of the peristome. In *Ephemeropsis* these are robust, long and thick, with the lamellae well developed and with the dorsal median line widely grooved, as in many Hookeriaceous mosses; whereas in *Archephemeropsis* they are described by Renner as very short, with the lamellae practically absent, and with the median line, as well as the transverse articulations of the dorsal plates, robustly and highly ridged. From his illustrations it would also appear that the median line, which is of the well-known zigzag type, is confined to about the lower one-third portion of the tooth, the upper part having the dorsal plates with their surfaces entire. The teeth are certainly very short, but whatever might be the taxonomic importance of the other structural differences if they were constant, they cannot be entirely relied upon here, because I have found that the peristome in the New Zealand plant does not always conform to the above description. For one thing, the ventral lamellae sometimes project, at any rate slightly, in the upper part of the tooth, and for another the median line, in the Marlborough plant especially, is often somewhat grooved, and in one case, in material from Atiamuri, I have seen a tooth actually split in the middle. The peristome characters therefore seem to be somewhat unstable, and I do not think that they support a generic separation. It seems that the endostome structure, which is very delicate, agrees with that of *Ephemeropsis*. There is a marked difference in the spores, because in the East Indian moss they are spherical or ovoid and

about 50μ in diameter; whereas in *Archephemeropsis* they consist of, or rather have (in the capsule itself) developed into 4–5-celled fusiform or cigar-shaped bodies, 100–120μ long, that exactly resemble a type of brood-body which is common amongst mosses and which, indeed, is developed on the protonema of the East Indian plant. They naturally differ in not having the specialised basal cell which facilitates the dehiscence of a normal brood-body from the protonema on which it is usually produced, but in other respects the resemblance is perfect. In Dixon's account (1928) he mentioned that he had not seen spores, but had found unicellular or bicellular bodies which he was inclined to think were brood-bodies. Fleischer (1929) considered that they were spores in process of germination, and Renner treats the fully developed structure as a type of multicellular spore. My investigation showed that before the lid falls these structures can be found in various stages of development, from unicellular oval bodies to the matured fusiform body, and even in a quite immature capsule I have found cells in process of division into as many as three cells. Incidentally, it is worth mention that I have seen more than once the commencement of germination of the mature 4–5-celled bodies. This took the form of a prolongation and narrowing of one of the terminal cells, and no doubt successive transverse walls would then be formed so as to commence the growth of a protonema. There can be no doubt that the unicellular bodies observed by Dixon and the writer are the true spores of *Archephemeropsis,* and that we have here a new type of multicellular spore, using that term in the sense that it is used by systematists to apply to what is in reality a young gametophyte (Chalaud, 1934). Such spores are found now and then in mosses, but the present form, consisting as it does of a short filament divided by parallel walls, is, as Renner states, something quite new. From a taxonomic point of view, however, I do not think that the character should be treated as of more importance than any other multicellular spore. The production of such spores is not in itself a decisive generic character. In for instance the genus *Ulota,* one species, *U. membranata* Malta, has them, whilst the other species have unicellular spores. It seems to me that in this case the character is not linked with other differences sufficiently important to justify more than a specific separation. I would therefore propose the combination *Ephemeropsis trentepohlioides* (Renn.) Sainsb. for the New Zealand plant. Investigation of the spore production and development here with fresh material would be a promising line of research on one of the world's most interesting mosses.

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